**CLAIMS :**

1.A method for producing DME, which comprises the steps of:

(i) introducing a feed gas mixture containing hydrogen and CO to a DME synthesis reactor, wherein the feed gas mixture is reacted in the presence of a methanol synthesis catalyst and an acid catalyst for the dehydration of methanol, to provide a crude product stream containing DME and $CO_2$;

(ii) separating the crude product stream into a $CO_2$ rich stream and a DME rich stream;

(iii) introducing the $CO_2$ rich stream to a reverse water gas shift (RWGS) reactor wherein it is reacted with hydrogen in the presence of a catalyst to provide a CO rich stream, while recovering the DME rich stream as a product; and

(iv) recycling the CO rich stream to step (i).

2. The method of claim 1, wherein the reaction in the reverse water gas reactor is carried out, in the presence of an oxide catalyst, at a temperature ranging from 400 to 1,200 ℃ under a pressure ranging from 1 to 100 atm.

3. The method of claim 2, wherein the oxide catalyst is ZnO supported on or co-precipitated with an oxide selected from $Cr_2O_3$, $Al_2O_3$, $ZrO_2$, MgO, MnO, $SiO_2$ and a mixture thereof, the content of ZnO being 10 to 90 % by weight based on the total weight of the catalyst.

4. The method of claim 3, wherein the ZnO catalyst further comprise an oxide of Cu or Mn in an amount of 0.01 to 60 % by weight based on the total weight of the catalyst.

5. The method of claim 2, wherein the oxide catalyst is $MnO_x$(x=1~2) supported on or co-precipitated with an oxide selected from $Cr_2O_3$, $Al_2O_3$, $ZrO_2$, MgO, $SiO_2$ and a mixture thereof, the content of $MnO_x$ being 1 to 99 % by weight, preferably 1 to 40 % by weight based on the total weight of the catalyst.

6. The method of claim 2, wherein the oxide catalyst is an alkaline earth metal oxide supported on or co-precipitated with an oxide selected from $Cr_2O_3$, $Al_2O_3$, $ZrO_2$, MnO, $SiO_2$ and a mixture thereof, the content of alkaline earth metal oxide being 1 to 99 % by weight, preferably 1 to 40 % by weight based on the total weight of the catalyst.

7. The method of claim 6, wherein the oxide catalyst is a hexaaluminate comprised of BaO, MgO and $Al_2O_3$ as main components.

8. The method of claim 2, wherein the oxide catalyst is NiO supported on or co-precipitated with an oxide selected from $Cr_2O_3$, $Al_2O_3$, $ZrO_2$, MgO, $SiO_2$ and a mixture thereof, the content of NiO being 1 to 20 % by weight, preferably 1 to 10 % by weight based on the total weight of the catalyst.

9. The method of claim 1, wherein the molar ratio of hydrogen and CO in step (iv) is controlled to 0.9 ~ 1.5: 1.